KATHOLIEKE UNIVERSITEIT
LEUVEN

Faculty of Business and Economics

Simultaneous Experimentation as an entrepreneurial strategy for emergent markets: Transcending the trade-off between flexibility and funding?

Petra Andries, Bart Van Looy and Koenraad Debackere

DEPARTMENT OF MANAGERIAL ECONOMICS, STRATEGY AND INNOVATION (MSI)

OR 0910

Simultaneous Experimentation as an entrepreneurial strategy for emergent markets:

Transcending the trade-off between flexibility and funding?

Dr. Petra Andries
Expertisecentrum O&O Monitoring
University of Leuven
Dekenstraat 2
3000 Leuven
Belgium
Tel. 00 32 16 32 57 61
Fax. 00 32 16 32 57 99
petra.andries@econ.kuleuven.be

Prof. Dr. Bart Van Looy
Department of Managerial Economics, Strategy and Innovation
University of Leuven
Naamsestraat 69
3000 Leuven
Belgium
Tel. 00 32 16 32 69 01
Fax. 00 32 16 32 67 32
bart.vanlooy@econ.kuleuven.be

Prof. Dr. Ir. Koenraad Debackere
Department of Managerial Economics, Strategy and Innovation
University of Leuven
Naamsestraat 69
3000 Leuven
Belgium
Tel. 00 32 16 32 41 77
Fax. 00 32 16 32 41 67
koenraad.debackere@econ.kuleuven.be

Keywords: entrepreneurial opportunities, business model, uncertainty, commitment, experimentation

Acknowledgements: We would like to thank Cathy Lecocq for her assistance with data collection and for her valuable comments in developing earlier versions of this paper.

ABSTRACT

The unpredictable nature of emergent markets implies that ventures entering such markets are confronted with technological and commercial uncertainty. Defining a viable business model under such circumstances is a complex and precarious endeavour. Previous research has either advanced the idea of focus – in order to attract resources and realize first mover advantages – or sequential experimentation financed through bootstrapping, implying limited resources during initial phases of the venture. As such, a trade-off between flexibility and resource acquisition has been introduced. Within this contribution we explore how ventures starting up in emergent industries can balance the attainment of financial resources with flexibility and business model adaptation. Based on a sequence analysis of six case studies, we identify two distinctive approaches to business development in emergent industries: focused commitment versus simultaneous experimentation. Our findings reveal that focused commitment is instrumental for acquiring resources but at the same time impedes flexibility, while simultaneous experimentation allows to attract resources while maintaining manoeuvring space for business model adaptation. An analytical comparison of both approaches suggests that simultaneous experimentation is indeed a more viable strategy when entering emergent industries.

INTRODUCTION

Successful exploitation of an entrepreneurial opportunity requires the development of a business model, which translates the opportunity into particular configurations that create and capture value (Amit and Zott, 2001; Chesbrough and Rosenbloom, 2002). However, for ventures in emergent industries, this is not straightforward. Emergent industries are characterized by considerable levels of uncertainty both in terms of technical and market feasibility (Karlsson and Nyström, 2003; Anderson and Tushman, 1990). As a consequence, the set of feasible opportunities and interesting business models is often not predictable in advance and the ones envisaged are of a highly conditional nature (Druilhe and Garnsey, 2004; Alvarez and Barney, 2007).

Within highly uncertain settings opportunities can be enacted by experimenting with business models and redefining them based on consumer and market reactions (Alvarez and Barney, 2007). When business models are still under development, 'bootstrapping' including acquiring financial resources from 'fools, family and friends' have been identified as instrumental to finance these business model changes (Alvarez and Barney, 2007; Bhide, 1992; Winborg and Landström, 1997, 2001). However, these funding mechanisms limit investment possibilities during the first, 'fluid', phase of the venture, eventually jeopardizing the enactment of opportunities. An alternative approach to opportunity creation in emergent industries implies commitment to a specific business model (Garud and Van de Ven, 1992; Choi, Lévesque and Shepherd, 2008). While such commitment may be instrumental for realizing first-mover advantages and facilitates the mobilisation of resources, it is not clear whether it sufficiently allows for flexibility in case the chosen business model turns out to be unviable. This raises the question how entrepreneurial ventures in emergent industries can strike a balance between conflicting demands – creating a clear and convincing vision and commitment towards investors while maintaining sufficient levels of flexibility – when developing their business model.

In this paper, we perform a sequence analysis of six in-depth case studies of growth-oriented companies. We observe the use of two distinctive approaches to business model development in emergent industries: 'focused commitment' and 'simultaneous experimentation'. Both approaches differ in terms of rationale and implications for funding and for flexibility in terms of business model development. Whereas ventures using focused commitment clearly sacrifice flexibility in return for financial investments and expected first-mover advantages, planned experimentation with multiple business models in parallel – which differs from the sequential experimentation approach discussed in existing literature - allows ventures to attract external investments while at the same time maintaining manoeuvring space for business model changes. Our work contributes to the existing literature on opportunity creation, experimentation, and effectuation. It also bridges the seeming contrast between 'planning' and 'action'.

In the remainder of the paper, we first outline the theoretical background of the study with respect to the development of business models in emergent industries. In a subsequent section, we discuss the research design adopted. We then outline in detail the insights obtained from in-depth case studies. Finally, by means of an analytical model, we explore the relevancy of both approaches for entrepreneurial ventures in emergent markets. We conclude by discussing implications, limitations and directions for future research.

BACKGROUND

Entrepreneurial opportunities

Entrepreneurial opportunities have been defined as '*situations in which new goods, services, raw materials, markets and organizing methods can be introduced through the formation of new means, ends, or means-ends relationships*' (Eckhardt and Shane, 2003, p. 336). These opportunities arise when competitive imperfections exist in the market. Many entrepreneurship scholars have assumed that these market imperfections come into existence because of changes in the venture's environment,

such as technological changes, political and regulatory changes, as well as consumer preferences (Shane, 2003). This implies that the entrepreneurial venture searches for, identifies and then exploits an existing opportunity. However, other authors have advocated that competitive imperfections do not only arise exogenously, but can also be created by the entrepreneurial venture (for an excellent overview, see Alvarez and Barney, 2007 and Zahra, 2008). The actions, reactions, and enactment of entrepreneurs create entrepreneurial opportunities (see also the social constructionist view of Weick, 1979). Whether the entrepreneurial venture identifies or creates potential entrepreneurial opportunities, its performance will depend on exploiting the right entrepreneurial opportunities (Zahra, 2008).

The business model

Exploiting opportunities requires the development of a business model, which translates opportunities into particular configurations that create and capture value (Amit and Zott, 2001; Chesbrough and Rosenbloom, 2002). Sources of value creation have been discussed from different angles and perspectives. Transaction-cost economics considers transaction efficiency as a major way of reducing costs and, consequently, as a source of value creation (Barney, 1999; Williamson, 1975, 1981). Porter's (1985) value chain framework explores both the primary and the support activities of the firm. In this view, value can be created by organizing every activity so that it lowers buyers' costs or raises buyers' utility. The resource-based view and the dynamic-capabilities emphasize the importance of combining and developing a set of scarce, durable and difficult to imitate resources and capabilities, resulting in value creation (Wernerfelt, 1984; Barney, 1991; Barney, Wright, and Ketchen, 2001). Research on strategic networks has focused on the density, centrality, size, and governance of company networks as drivers of value creation (Jarillo, 1995; Dyer and Singh, 1998).

The concept of the business model allows to encompass these different perspective on value creation by explicitly incorporating a variety of constituents of value creation (Amit and Zott, 2001). A business model can be defined as "*a concise representation of how an interrelated set of decision*

variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets" (Morris, Schindehutte and Allen, 2005, pp. 727). A business model is a construct that mediates the value creation process by selecting and filtering technologies and ideas, and translating them into particular configurations that can be offered to a chosen target market (Teubal, Yinnon and Zuscovitch, 1991). A company's business model consists of different components, representing value creation potential from multiple sources. The most consistently emphasized components (see Morris et al., 2005) concern (a) the value proposition or offering, (b) the customer (including type of customer and geographical area), (c) the economic factor, the revenue model, or how the firm makes money, and (d) the internal processes and competencies, including production/operations, sales/marketing, information management, technology, finance, supply chain management, and networking (see also Magretta, 2002; and Hamel, 2000).

Uncertainty in emergent markets

Ventures are generally confronted with risk when exploiting entrepreneurial opportunities. A decision-making context is risky if the venture can gather sufficient information to identify possible outcomes associated with a decision, as well as the probability distribution of those outcomes. Some ventures however, face not just mere risk, but uncertainty. Uncertainty – also called 'Knightian uncertainty' – has been defined as characteristic of a situation in which probability distributions are not known (Knight, 1921; Cohen and Winn, 2007). The problem solver understands the structure of the problem, including the set of relevant decision variables, but does not know the exact values these variables should take (Schrader, Riggs and Smith, 1993)[1]. A difference therefore exists between the amount of information available and the amount of information required to execute a task at hand (Galbraith, 1977)[2].

[1] Note that the notion of uncertainty differs from the notion of risk. In situations of risk, probability distributions are known.

[2] Economists have developed several ways of modeling Knightian uncertainty – for example, as a probability distribution of probability distributions, by using non-additive expected utilities, and by using subjective expected utility theory (for an overview, see Camerer & Weber, 1992).

Especially within emergent industries, new ventures are confronted with uncertainty regarding their business model. Within emergent industries, the nature and the outcome of the technical activities are inherently unpredictable and technological options are at best marginally understood (Simon and Houghton, 2002; Steensma et al., 2000; Dowell and Swaminathan, 2006); market selection forces are yet unclear (Eisenhardt and Schoonhoven, 1990; Autio and Lumme, 1998; Chesbrough, 2003; Chesbrough and Rosenbloom, 2002; Saemundsson and Lindholm Dahlstrand, 2005); distribution channels and sources of supply are problematic, market needs are not clearly defined and, thus, market viability cannot be defined a priori (see Abernathy and Utterback, 1975; Abernathy 1978; Eisenhardt and Schoonhoven, 1990; Bhide, 1996; Teubal et al., 1991). What the market will become depends on a multitude of decisions by a variety of stakeholders, and clarity will only arise when entrepreneurial activities resulted in the development of the industry (Dutta and Crossan, 2005). Stated otherwise, the feasibility of any business model in emergent markets cannot be predicted with certainty ex ante (Buchanan and Vanberg, 1991; Druilhe and Garnsey, 2004).

Developing business models in emergent markets

Enacting opportunities within such emerging industries hence present itself as a complex and hazardous enterprise in which experimenting with and redefining business models - based on consumer and market reactions – seems highly instrumental (Alvarez and Barney, 2007). Through experimentation, the original idea can be adapted into a viable business model through "*a series of trial and error changes pursued along various dimensions*" (Nicholls-Nixon, Cooper and Woo., 2000, p. 496). By experimenting with specific business models and incorporating feedback from the environment, entrepreneurial ventures adopt an active stance towards learning about the environment (Simon and Houghton, 2002). If outcomes are negative, the initial business model is redefined and a new experiment is launched (Garud and Van de Ven, 1992; Minniti and Bygrave, 2001; Chakravarthy, 1982, Lichtenstein, Dooley and Lumpkin., 2006; Shepherd, Douglas and Shanley, 2000). This approach

implies that ventures will deviate from their initial business model as they incorporate information that becomes available during the entrepreneurial trajectory (Hmieleski and Corbett, 2008; Gruber, MacMillan and Thompson, 2008; Corbett, 2007). While such a sequential development path seems highly appropriate to deal with the uncertainty and unpredictability of emergent industries, it remains less clear how this approach can convince stakeholders – and more specifically investors – to support and strengthen the entrepreneurial venture during the – sometimes lengthy – experimental development period. After all, research has shown that investors are not likely to finance reconfigurations, since they often cannot know whether the initial business model was wrong or whether it was poorly executed (Bhide, 1992). If the latter seems plausible to them, they will not take the risk of investing in the venture again. Given VCs' aversion, 'bootstrapping' including the use of financial resources from 'fools, family and friends' is often used to finance these business model changes (Alvarez and Barney, 2007; Bhide, 1992; Winborg and Landström, 1997, 2001). However, these funding mechanisms pose problems in the sense that investment possibilities during the first phase of the venture are limited, and that growth needs to be kept under strict control, which possibly jeopardizes the enactment of some interesting opportunities (Bhide, 1992; 2000).

Earlier research has proposed an alternative approach to opportunity creation in emergent industries. It implies commitment to the initial business model (Garud and Van de Ven, 1992; Van de Ven and Polley, 1992; Choi, Lévesque and Shepherd, 2008). Such early commitment may be instrumental in realizing first-mover advantages (Choi et al., 2008) and may help to convince investors more easily (Garud and Van de Ven, 1992). It allows for routinized behaviour, which in turn enables the venture to effectively handle liabilities of newness and to invest in relationships with important stakeholders such as customers and suppliers (Shepherd et al., 2000, Stinchcombe, 1965). It is obvious that such alignment with investors and other stakeholders could facilitate the co-creation and enactment of the entrepreneurial opportunity (Weick, 1979). However, existing research does not discuss how the venture is affected if the entrepreneurial opportunity to which it has committed, turns

out to be unprofitable. So, although this committed approach allows for growth-oriented entrepreneurial activities, it is not clear whether this approach sufficiently allows for flexibility in case the chosen business model turns out to be unviable (Andries & Debackere, 2007).

In this contribution, we therefore focus on how entrepreneurial ventures in emergent industries can strike a balance between conflicting demands – creating a clear and convincing vision and commitment towards investors while maintaining sufficient levels of flexibility – when developing their business model. Given that we want to explore how new ventures in emergent industries characterized by uncertainty develop their business model – including their rationale and consequences in terms of external financing and flexibility of the venture – we adopted an in-depth case-study approach (Eisenhardt, 1989), where ventures in emergent industries act as the unit of analysis. In the next section, we clarify the methodological approach adopted.

METHODOLOGICAL APPROACH

Case-study research has been advanced as the most adequate for developing fine-grained insights into real-time processes (Yin, 1994; Janesick, 1994; Eisenhardt, 1989). We retrospectively studied and analyzed six new ventures, specifically selected in view of our research question, thereby increasing external validity (Yin, 1994; Cook and Campbell, 1979). These six companies were active in various emergent industries. The main selection criterion was that they were all initially confronted with uncertainty regarding their business model (see Table 1)[3]. To this end, we used the definition of uncertainty by Schrader et al. (1993), as introduced in the previous section of this paper: a venture is confronted with uncertainty when its decision makers understand the structure of the problem (namely, the set of relevant business model components) but do not know the optimal values for some of these business-model components.

[3] The names of the ventures in our case study have been changed for reasons of confidentiality.

When engaging in case-study analysis, the use of a set of central constructs can be seen as beneficial (Pettigrew, 1987; Eisenhardt, 1989, Van de Ven and Poole, 1990). In this study, we investigate various approaches taken to business model development. We, therefore, document and interpret the concept of 'business model' as it changes over time. This construct stems directly from our research question and is hence specified a priori. We documented and analyzed changes in the following business model components: (1) product/service offering, (2) customer type (3) marketing, (4) distribution, (5) production (6) technology, and (7) organizational structure [4]. This leads us to regard any observed combination of the five components listed above as one specific business model. If a company, at the same time, experiments with two or more such combinations, we regard these as different business models. Overall, the dimensions of our measurement correspond well to the definition by Morris et al. (2005), which in turn builds on a range of studies, implying content validity of our business model construct (Chandler & Lyon, 2001).

Focused case-study research not only benefits from the use of central constructs but also implies different levels of analysis (Pettigrew, 1990, Pentland, 1999, Van de Ven and Poole, 1990). We first analyzed business model development in each venture. We then compared the development pattern over the six cases. To assure reliability of our findings, we used the following case study protocol (Yin, 1994). In a first phase, a historical description of each company was created, based on the information from semi-structured interviews and document analysis (see Table 1). Documents – such as company websites, available business plans and, in some cases, e-mail correspondence – were read and analyzed in preparation for the interviews. In addition, complementary documents were provided by the interviewees after the interviews[5]. The resulting historical descriptions were presented to the

[4] We chose to document precisely these constructs, based on the conclusion of the literature review by Morris et al. (2005) that the most prominent components of a business model are (a) the value proposition or offering, (b) the customer, (c) the economic factor, the revenue model or how the firm makes money, and (d) the internal processes and competencies. Components 4 through 7, as documented by us, jointly represent the internal processes and competencies.

[5] For each case, interviews and document analysis were performed until a consistent account of the case could be constructed. In the cases of @Music and OOPs, we encountered multiple inconsistencies between interviews and documents, which were then clarified by engaging in several additional interviews.

interviewees in order to assess accuracy and completeness. In some cases, information was added, refined or corrected. We hence triangulated the documentation of the business model construct and involved key informants within each venture to review our historical descriptions, hereby increasing construct validity (Gibbert, Ruigrok and Wicki, 2008; Yin, 1994). This analysis resulted in process maps for every venture as well as narrative descriptions of the entrepreneurial trajectory.

- INSERT TABLE 1 ABOUT HERE -

In a second phase, these descriptions were used to conduct sequence analysis, which enables the identification of patterns in temporal data (Abbott, 1990; Van de Ven and Poole, 1990). Firstly, we defined an incident as a change in a venture's business model. For the six cases, 20 incidents in total were identified; i.e. 20 moments in time when the business model changed. In a next step, all events were coded as introductions and/or abandonments of one or more business model. More precisely, for each event, we coded how many business models were added and how many were dropped. For each of the ventures, this coding was performed independently by two of the authors. Both authors identified the same 20 incidents. Of the 20 events, 17 were initially coded in the same way (i.e. as the exact same number of abandoned and introduced business models) by both authors, leading to an 85% inter-rating reliability. The differences in coding were addressed through discussion and by obtaining additional information from the ventures resulting in consensus for all events in a second and final round. In a next phase, the number of introduced and abandoned business models per year, as well as the total number of business models per year, were mapped on a time-line for each venture. We then applied multidimensional scaling techniques to classify our six case studies.

CASE STUDY FINDINGS

Multidimensional scaling allows to explore similarities in data by locating items in a N-dimensional space (Kruskall and Wish, 1978; Young, 1987). Based on the number of abandoned business models and the total number of business models pursued in each year of the company's existence, all cases under study have been situated in a two-dimensional space ($R^2 = 0,76$). As can be seen in Figure in Figure 1, four of the ventures (Music, OOPs, SiS, and RegMed) are very similar in terms of the number of business models they add each year (X-axis) and the total number of business models they use each year (Y-axis). Very early on, they select one (in the case of RegMed: two) business model(s) and stick to this decision for several years (between two and five years). Hence, these ventures opt for focus from inception onwards. In the remainder of the paper, we will refer to this approach as 'focused commitment'. Figure 1 also indicates that the other two companies in our case study (Image and L-goritm) do not fit this pattern. They differ strongly from focused ventures both with respect to the number of business models simultaneously pursued and the number of business models added. Based on the historical description and the sequence analysis, we see that they use a much more experimental approach in the first years of their existence. Whereas experimentation has been referred to in the literature as "*a series of trial and error changes"* (Nicholls-Nixon et al., 2000, p. 496), we find however that the experiments of these companies are not of a sequential nature. More precisely, we observe that these ventures evaluate a variety of business models simultaneously. They spend between two and five years building up a portfolio of business models, which they then gradually narrow down – abandoning the least promising experiments – until a small set of viable business models remains. We will refer to this approach as 'simultaneous experimentation'. The main difference between L-goritm and Image pertains to the former starting out with a portfolio of business models that it develops further over time, while the latter begins with one single business model and creates a portfolio of different alternative business models thereafter.

The identification of two clearly distinctive patterns is used as a starting point to further clarify the rationale, as well as the implications for external financing and for flexibility in terms of business model

development of both 'focused commitment' and 'simultaneous experimentation'. The findings presented in the next section are based on an in-depth analysis of all six cases. However, in order to increase the readability of the paper, we present only two case examples to clarify the constituents of both approaches: OOPs, which committed to one specific business model and L-goritm, which opted for simultaneous experimentation.

- INSERT FIGURE 1 ABOUT HERE -

Focused commitment

We find that some ventures commit very early to one single business model and stick to this business model. In the case of OOPs (see Figure 2), the founders soon after inception in 1998 commit to the development of 'Spoot', a software product for B-to-C applications. Previous consulting activities are discontinued in 1999 in order to concentrate solely on product development and sales. Experienced sales people are hired. In 2000 – when sales are still not improving according to plan – a sales manager and additional salespeople are hired. The company develops a clear structure consisting of separate departments for sales, services, and R&D – with a clear division between R&D and services – thereby committing further to the initial business model. Even though many technical problems are encountered and sales do not materialize as planned, the company sticks to its business model (i.e. the development and sales of a product for B-to-C applications) until 2001.

- INSERT TEXT BOX 1 ABOUT HERE -

- INSERT FIGURE 2 ABOUT HERE -

Rationale for focused commitment

Early commitment for the ventures under study is not due to a lack of awareness in this respect; it is in fact a deliberate choice in the face of uncertainty. Founders and investors actually acknowledge at the

start that many factors affecting the viability of the business model are uncertain; they decide nonetheless to commit early to the development of one specific and focused business model. In the case of OOPs, founders have developed profit-making service activities characterized by a low degree of uncertainty. However, they decide to focus solely on the development of a product for which technical and market viability remains to be proven.

In our interviews, stakeholders mentioned two main reasons for committing to one specific business model despite the presence of uncertainty. Firstly, interviews with founders show that they commit early in order to build up learning effects and first-mover advantages. Secondly, our interviews with founders and investors further reveal that focused commitment improves the clarity of the value proposition for different stakeholders, including strategic partners, investors and employees. They believe this will enable them to convince stakeholders of the value of the business model, and this support will make the business model successful.

Implications of focused commitment

The choice of one specific business model results in clarity with regards to the organizational configuration of the venture. Objectives and activities are delineated in line with the value proposition adopted, and employees are attracted whose competencies reflect the objectives outlined in the business model envisaged. This results in functional structuration and formalization (see also Aldrich and Auster, 1986). OOPs organizes itself in functional departments, reinforces the sales organization with highly experienced people, and installs a clear division between R&D and sales. All these efforts imply significant expenditures and result in a consistent, dedicated, organizational configuration that reflects the business model adopted. Our case studies clearly show that external investors are willing to finance these significant expenditures. The external investors endorse focus and commitment in the belief and hope that it will allow ventures to achieve growth as fast as possible. They enter the

investment agreement based on the company's commitment to a specific business model. In the case of OOPs, the investors are actually pushing the founders to focus solely on product development.

Over time, the chosen business model is developed and uncertainty pertaining to underlying assumptions is reduced. This process can yield outcomes ranging from full confirmation of initial assumptions to the complete opposite. While Solow (1996) demonstrated that early luck might have a persistent effect in terms of economical performance, in all our case studies, crucial assumptions turned out to be too optimistic. Our case studies show that, when ventures are confronted with the discrepancies between initial assumptions and the unfolding practices, change becomes inevitable for their survival. In line with the propositions advanced by Miller and Friesen (1984) and Gersick (1991), such change processes are of a radical nature. Redefining the business model requires changing the mindset of the entrepreneurial team and its stakeholders. It implies the choice of a different set of activities, skills and structures. Some of the developed competencies may become obsolete, while others may be missing. Moreover, our case studies confirm that convincing investors to fund radical reconfigurations is difficult, since these investors may query whether the initial business model was wrong or whether it was poorly executed (cfr. Bhide, 1992). In the case of OOPs, the founders of OOPs agree at the beginning of 2001 on the need to change the business model and to drastically restructure the venture by dismissing employees and reorganizing the different departments. However, they differ in their view on the right direction for the company to take and one of them leaves the company. The lack of sales and the departure of one of the founders weaken the confidence of the investors. One of the investors proposes a merger but the remaining founder does not agree. He initiates a business model change in 2003. However, investors do not support this new direction and OOPs files for bankruptcy.

Simultaneous experimentation

- INSERT TEXT BOX 2 ABOUT HERE -

- INSERT FIGURE 3 ABOUT HERE -

We find that some ventures do not commit early to one specific business model but opt instead for a flexible approach by experimenting with multiple business models in parallel. In these cases, uncertainty is not only recognized but also explicitly translated into the initial business plan and into the venture's approach to business model development. L-goritm (see Figure 3) initially experiments with radically different business models (different products and services, different market segments, different techniques, and various geographical markets) simultaneously. In 1995, the company offers software for reverse engineering, as well as services for quality control – and this in a variety of sectors. In addition, it experiments with a combination of indirect and direct sales during the period 1997-98.

Rationale for simultaneous experimentation

From interviews with stakeholders, we found that experiments are executed in parallel for two reasons. Firstly, engaging in different activities is seen as instrumental in spreading risk. If one business model proves unviable, there is still a chance that one of the other options turns out to be successful. In doing so, the ventures maintain a significant degree of strategic flexibility (Raynor, 2007). Secondly, this diversified approach allows ventures to learn about a relatively broad range of business models, and building up experience with a variety of business models is considered essential to achieve uncertainty reduction. Learning about one option can also reduce uncertainty about other options. We observe that the ventures use the knowledge acquired while exploring one option to re-assess and re-define the nature of, and the priorities for, the activity portfolio as a whole. L-goritm gathers knowledge and expertise from its service activities and – based on this experience – decides to add hardware components to its software offerings. Hence, ventures explicitly regard engagement in multiple activities as instrumental in re(de)fining their business models.

Implications of simultaneous experimentation

Our case-study findings show that some investors are willing to invest in ventures that explicitly acknowledge uncertainty and experiment with a variety of business models in parallel. L-goritm has the intention of developing software in the medium term but, from start-up, provides services that generate cash in the short term (need better example). The investors of L-goritm – when closing the investment agreement – are fully aware and supportive of the venture's plan to experiment with various business models. Together with the venture, they monitor the progress for every business model experiment. They do not regard these experiments as resource-consuming incidents which need to be avoided, but as intelligent and necessary ways to select the most interesting entrepreneurial opportunity. However, even though investors are supportive of simultaneous experimentation, the development of multiple business models still poses challenges in terms of resource requirements. We find that ventures use various methods to keep total expenditures under control. Firstly, they use low-cost probing strategies (including experimental products and strategic alliances) to see what types of product and service markets are more responsive to (cfr. Brown and Eisenhardt; 1997, 1998). Secondly, they include business model experiments with short-term cash-generating potential. And in a conscious and planned manner, they try to enact spill-overs between the different activities undertaken. This is done by developing activities that can be re-used in different business model logics. L-goritm develops service activities to generate cash in the short term. In addition, these service activities provide the company with unexpected insights into the importance of hardware. They then use this knowledge to complement their product offerings.

Simultaneous experimentation with a variety of business models implies that these entrepreneurial firms need to organize their activities accordingly. When looking at the organization of the venture when experimenting, a project-based configuration emerges, resembling the project-based nature of R&D departments. Such organic structures provide greater flexibility (Fiegenbaum and Karnani, 1991). During the first years, L-goritm's founders take care of all business activities

themselves. After a while, three employees are hired but the structure remains project oriented rather than functional. Over time, specific units are formed, each of them focusing on business models considered worthwhile pursuing.

Since these ventures acknowledge that different conceivable business models are all characterised by uncertainty, the decision to commit to one option is postponed until more information with respect to a range of value propositions becomes available. As uncertainty is reduced, the range of business models is gradually narrowed down until a viable business model emerges. L-goritm gradually narrows down its range of activities between 1998 and 2001, and ends up with a successful business model. This portfolio reduction entails organizational changes. The ventures evolve from unstructured, loose configurations resembling the project-based nature of R&D departments to more elaborate structures, as the variety of business models is narrowed down. In the case of L-goritm, more employees are hired as the uncertainty regarding the business models' viability is reduced and the variety of business models is narrowed down. A German company is taken over to fully implement the remaining viable business model.

- INSERT TABLE 2 ABOUT HERE -

To sum up (see Table 2), focused commitment is a deliberate choice in the face of uncertainty because it holds the promise of realizing learning effects and first-mover advantages and because it is instrumental in mobilising different stakeholders, among whom investors figure prominently. It implies significant expenditures for the development of an organizational structure and the hiring of specialised personnel whose skills match the chosen business model. If, afterwards, initial assumptions on which the choice of the particular business model was based turn out to be incorrect, then adaptation efforts – needed for survival – will be of a radical nature. As our cases illustrate, such radical change processes are hazardous and painful. In order to achieve these radical changes, the venture needs to become flexible again as to its assumptions and its organizational configuration. Our case studies show that

founders, employees and investors are not always capable or willing to do so. This raises the question of whether alternative scenarios are plausible and even preferred. And indeed, some of the ventures in our case study were found to use a different approach, experimenting with multiple business models in parallel. Simultaneous experimentation can be seen as a way to address uncertainty, by learning about a broad range of potential business models. These ventures opt for a project-based organization, deploy low-cost probing strategies, include business model experiments with short-term cash-generating potential, and enact spill-overs in order to maintain total expenditures within reasonable limits. The latter is achieved by developing activities that can be re-used within the framework of different business models. Our case studies show that at least some external investors are willing to invest in planned simultaneous experimentation and that they monitor progress for each business model experiment. As a result of simultaneous experimentation, uncertainty is reduced with respect to a range of business models. This uncertainty reduction facilitates the gradual narrowing-down of the range of options until a viable business model is found.

CHOOSING BETWEEN APPROACHES: AN ANALYTICAL FRAMEWORK

Now that we have identified the use of two different approaches to business model development in emergent industries that are both able to convince external investors, an obvious question is which model is more appropriate. In this section, we therefore develop an analytical framework to generate propositions regarding the appropriateness of focused commitment versus simultaneous experimentation. We consider a model more appropriate if it is able to yield higher levels of expected profits compared with its counterpart.

Our case studies reveal that some technology-based ventures in emergent markets commit early to one specific business model and put in place an organizational configuration aimed at the implementation of this business model. By fully developing the chosen business model, uncertainty

pertaining to the underlying assumptions is reduced. If these assumptions turn out to be incorrect, radical change of the business model becomes inevitable for the venture's survival. Significant efforts and investments are then needed to dispose of organizational structures, ideas and competencies that have become obsolete, and to persuade investors to invest in the creation of new, more appropriate arrangements and competencies. Hence, the expected profit from focused commitment for the initial period in the life of a venture can be formulated as follows:

$p * MaxTurnover_{(focused)} - FullLaunchCost + (1-p) * (MinTurnover_{(focused)} - ReconfCost)$

where p = the probability of success for a specific business model

$MaxTurnover_{(focused)}$ = the turnover for a successful business model that is fully implemented

FullLaunchCost = the cost to fully implement one specific business model

$MinTurnover_{(focused)}$ = the turnover for an unsuccessful business model that is fully implemented.

ReconfCost = the cost of abruptly reorienting the business when the initial business model turns out to be unsuccessful

If we assume that MinTurnover(focused) = 0, this formula can be re-formulated as follows:

$p * MaxTurnover_{(focused)} - FullLaunchCost + (1-p) * (0 - ReconfCost)$

or $p * MaxTurnover_{(focused)} - FullLaunchCost - (1-p) * ReconfCost$ (a)

While significant reconfiguration costs arise when a venture commits to a specific business model that proves to be unsuccessful, this is not the case when ventures experiment with a variety of business models in parallel. These entrepreneurial firms postpone the choice of a single option until more information with respect to a range of value propositions becomes available. As a consequence, they organize their activities on a project basis rather than developing a focused organizational

configuration. This implies that no reconfiguration costs arise when a specific business model experiment fails. Hence, the expected profit from simultaneous experimentation for one period in the life of a venture can be formulated in the following way:

$\Sigma_{i:1\rightarrow n}$ [p * $MaxTurnover_{(unfocused)}$ + (1-p) * $MinTurnover_{(unfocused)}$ - ExperimentCost]

where n= number of experiments

p = the probability of success for a specific business model

$MaxTurnover_{(unfocused)}$ = the turnover for a successful business model experiment

$MinTurnover_{(unfocused)}$ =the turnover for an unsuccessful business model experiment.

ExperimentCost = the cost for one specific business model experiment

If we assume that MinTurnover(unfocused) = 0, this formula can be re-formulated as follows:

$\Sigma_{i:1\rightarrow n}$ [p * $MaxTurnover_{(unfocused)}$ + (1-p) * 0 - ExperimentCost]

or n * [p * $MaxTurnover_{(unfocused)}$ - ExperimentCost] (b)

From comparing formulas (a) and (b), insights can be obtained about whether and under which conditions simultaneous experimentation is to be preferred over focused commitment. As formula (c) clarifies, this is the case when:

p*$MaxTurnover_{(focused)}$ - FullLaunchCost - (1-p)*ReconfCost < n * [p*$MaxTurnover_{(unfocused)}$ - ExperimentCost] (c)

Based on our case studies, we found that ventures committing to one specific business model regard learning effects and first-mover advantages as the main driver for early commitment (cfr. Choi et al., 2008). They hope that commitment will allow the venture to achieve growth as rapidly as possible. In the absence of learning effects, it is reasonable to assume that the turnover of one successful, fully implemented business model is equal to the total turnover of a variety of 'n' successful business model

experiments. In that case, spreading efforts over 'n' experiments does not have an effect on potential turnover. However, if learning effects exist, a fully implemented business model will yield a higher turnover than 'n' parallel experiments. Putting all efforts into one single business model will raise the potential turnover. Hence:

$MaxTurnover_{(focused)} = F * n * MaxTurnover_{(unfocused)}$ where $F \geq 1$ (and $F>1$ in case of learning effects) (d)

When comparing the cost of fully launching a business model with that of parallel experimentation, we should note that the ventures in our case study deliberately use low-cost probing strategies (including experimental products, futurists, and strategic alliances) to see what types of product and service markets are more responsive to (cfr. Brown and Eisenhardt; 1997, 1998), and that they combine different activities through which synergies can be created. In addition, we know from existing literature that experiments can be less costly than full implementation of a new idea or business model. This can be formulated as follows:

$ExperimentCost = 1/x * FullLaunchCost$ where $x \geq 1$

(and $x>1$ if the cost of an experiment is smaller than that of a fully launched business model) (e)

When substituting equations (d) and (e) in formula (c), we find that simultaneous experimentation is preferable to focused commitment if

$p*MaxTurnover_{(focused)} - (1-p)*ReconfCost - FullLaunchCost < n*[p*1/F*1/n *MaxTurnover_{(focused)} - 1/x*FullLaunchCost]$

$\Leftrightarrow p*MaxTurnover_{(focused)} - (1-p)*ReconfCost - FullLaunchCost < p*1/F*MaxTurnover_{(focused)} - n/x *FullLaunchCost$

$\Leftrightarrow p * (1- 1/F) *MaxTurnover_{(focused)} < (1-p) * ReconfCost + [1-(n/x)] * FullLaunchCost$

This allows us to discuss more analytically the conditions under which focused commitment and simultaneous experimentation are appropriate. Firstly, the latter becomes more appealing if 1/F is high, i.e. if learning effects and first-mover advantages are small. Recent research has clearly shown that first-mover advantages are indeed extremely limited in emergent industries (Dowell and Swaminathan, 2006). Firms that enter an emergent industry earliest have the longest life expectancy but their advantage lasts only until the dominant design emerges. Early entrants face inertial pressures that make them less likely to accomplish and survive the transition to this dominant design (see also Abernathy and Utterback, 1975). Secondly, parallel experimentation becomes more interesting if costs associated with reconfiguring the venture (ReconfCost) are high; i.e. if the cost of abruptly reorienting a focused, committed venture, when the initial business model turns out to be unsuccessful, is high. Our case studies show that these reconfiguration costs are in fact relatively high. Significant efforts and investments are needed to change the mindset of all stakeholders – including investors – and to replace or reconfigure organizational structures, ideas and competencies in order to effectively develop the newly adopted business model. According to Loch, Solt and Bailey (2008), "*…the VC investment process… tends to penalize the new venture when it misses its targets rather than nurturing it through a re-definition*" (see also Bhide, 1992). Failure jeopardizes trust, which plays a key role in company formation (Kohtamäki, Kekäle and Viitala, 2004). Thus, radical change processes are indeed hazardous and painful. Thirdly, from the mathematical formulas above, we see that simultaneous experimentation becomes preferable if n/x is low, i.e. if the cost difference between a portfolio of 'n' experiments and one full implementation is low or, in other words, if low-cost probing is possible and/or synergies can be created from different experiments in the portfolio (as was the case in the companies under study). Finally, simultaneous experimentation becomes more attractive if p, i.e. the probability of success for a specific business model is low. It is well known that this is the case in emergent industries. Very few configurations survive competition, and the number of firms drops drastically as a dominant design emerges (Abernathy and Utterback, 1975). Hence, it appears that, in emergent industries, most

conditions are such that they tend to favour simultaneous experimentation over a focused, committed approach to business model development.

CONCLUSION AND DISCUSSION

In this paper, we generated insights into how growth-oriented new ventures in emergent industries approach the development of a viable business model. Based on our case studies, we were able to document how and why commitment and experimentation are pursued in new ventures. Observing ventures that commit early to one single business model comes as no surprise; in contrast, the occurrence of ventures opting for simultaneous experimentation, i.e. trying out multiple business models in parallel, is less straightforward. These ventures spend between two and five years developing a portfolio of business models, which is gradually narrowed down until one, or a limited set of viable business models, remains. We hence clearly find that experimentation is not limited to the sequential template advanced in the existing literature, but can take on the form of simultaneous efforts. Moreover, an analytical comparison of both approaches clearly suggests that simultaneous experimentation with multiple business models is more appropriate when entering emergent markets.

Although our case studies confirm that ventures consider commitment to be useful for persuasion in situations of uncertainty, they furthermore show that ventures opting for the simultaneous experimentation approach were also able to attract external investors. These investors are supportive of planned and simultaneous experimentation efforts and are willing to engage in entrepreneurial ventures that experiment with a portfolio of business models. They deviate from the traditional, focused approach, where '*investors… prefer ventures with plausible, carefully though-out plans to address well-defined markets*' (Bhide, 1992). Our findings indicate that some VCs regard planned simultaneous experimentation as an intelligent approach for selecting the most interesting business model. The fact that VCs are willing to invest in ventures opting for simultaneous experimentation is important, since it is

well known that VCs have an important impact on the strategic decisions of new ventures (Fernhaber and McDougall-Covin, 2009; Jääskelaïnen, Maula and Seppä., 2006). Without their support, companies would not be able to opt for a simultaneous experimentation approach.

Our finding that external investors are supportive of planned and simultaneous experimentation efforts complements the work of Bhide (1992), who advanced the notion of bootstrapping, i.e. launching ventures with modest personal funds as a flexible alternative to using external capital. Bootstrapping poses problems in the sense that investment possibilities during the first phase of the venture are limited, if present at all, and that growth thus needs to be under strict control. If ventures adopting a simultaneous experimentation approach to business model development are able to attract investors, then flexible entries of a more capital-intensive nature become feasible in emergent industries. Hence, simultaneous experimentation possesses the advantage but not the disadvantage of bootstrapping and seems especially relevant for entries into industries that require considerable initial investments.

On a more conceptual level, our work contributes to the lively discussion on causation and effectuation. Sarasvathy (2001) discussed the relevance of causation and effectuation processes for the creation of new firms. Causation processes imply that entrepreneurs choose specific means (a specific organizational structure, specific employee skills, etc.) to create a desired effect (such as a specific business model). Effectuation processes, on the other hand, imply that a set of means is taken as given and the focus is on selecting between possible effects that can be created with this set of means. Whereas existing work has discussed effectuation as cognition or logic, research on how effectual logic translates into effectual behaviour is scarce (exceptions are work in progress by Fisher, 2008 and Mauer, 2008). We believe that the simultaneous experimentation approach identified in our case studies follows an effectual logic and can be regarded as closely related to effectual behaviour. In an effectual logic, the basis for taking action is means-driven; investment decisions are based on a commitment limit in terms of affordable loss, and the direction of development is highly influenced by stakeholders and by unforeseen events that are leveraged into new options (Mauer, 2008; Read et al.,

2009; Sarasvathy, 2008). The ventures in our case study that opt for a simultaneous experimentation approach start from their initial idea, capabilities and contacts to develop multiple business models. Specific business models are added to the portfolio based on contacts with suppliers, customers and other partners, and based on information gathered in the course of business-model experiments. A simultaneous experimentation approach therefore follows an effectual logic, since it takes a set of means as given and focuses on selecting between possible effects that can be created with this set of means. Whereas simultaneous experimentation implies the recognition of required change and adaptation, focused commitment, on the other hand, follows a causal logic where specific means (a specialised organizational structure, specialised personnel, and significant expenditures) are chosen to create a desired effect (namely, the implementation of one specific business model)[6].

Finally, our findings also suggest a reconciliation of the notions of 'action' and 'planning'. In Sarasvathy's earlier work (Sarasvathy, 2001) the effectuation logic is partly driven by chance or coincidence. "*Whoever first buys […] becomes, by definition, the first target customer. By continually listening to the customer and building an ever-increasing network of customers and strategic partners, the entrepreneur can then identify a workable segment profile"* (Sarasvathy, 2001, p. 247). Also other authors have attributes an important role for 'luck' in the creation of entrepreneurial opportunities (Alvarez and Barney, 2007; Arthur, 1989). However, we find that the ventures in our case study adopting a simultaneous experimentation approach do not just 'go with the flow'. Instead, they deliberately plan and develop multiple business model experiments. Contrary to the juxtaposition of 'planning' and 'action' by Liao and Gartner (2006) and the contrast between 'planning' and 'learning' in management literature in general (e.g. Mintzberg, Ahlstrand and Lampel, 1998), our findings suggest that planning and the development of a portfolio of business model experiments are not opposites but can instead be reconciled. Sarasvathy (2001) suggested that, when the future is uncertain, effectual

[6] Note that commitment does not necessarily imply only one business model. Pursuing several business models over longer time frames is also an option for ventures (see also Wiklund and Shepherd, 2008, on portfolio entrepreneurship). However, such a diversified or portfolio approach multiplies the resource implications introduced by commitment and, hence, can be seen as less relevant for launching an entrepreneurial venture in an emergent industry.

cognition is most appropriate, while Liao and Gartner (2006) said that early planning (as opposed to action) is beneficial under uncertainty. Our research overcomes this apparent contradiction by proposing that simultaneous experimentation – which implies planning combined with entrepreneurial action - is appropriate when confronted with uncertainty.

In discussing our research, some limitations should, of course, be kept in mind. The main objective of the paper relates to investigating processes of business model development within entrepreneurial ventures in emergent industries. Our findings suggest a third model, besides focused commitment and sequential experimentation. It goes without saying that further engagement in in-depth case studies may result in additional insights with respect to both the constituents of different models and the delineation of additional models.

In addition, while our analytical framework clearly suggests that a simultaneous experimentation approach seems more appropriate than focused commitment, further empirical research on the performance effects of these different approaches to venture development seems highly relevant. Such impact assessment not only requires translating our case study findings into an adequate panel-oriented research design (e.g. De Carolis et al., 2009), but also taking into account success factors identified by previous research, such as industry characteristics (Klevorick et al., 1995; Marsili, 2002; Shane, 2001), characteristics of the founding team (Delmar and Shane, 2006; Kirzner, 1997), legitimacy (Delmar and Shane, 2004) and available assets such as financial resources, patents, alliances, geographical location (DeCarolis and Deeds, 1999; Lerner, 1994). Finally, our research also points to the relevance of further research into the role and impact of investors: when and why are (some) investors more open to support simultaneous experimentation? To what extent do ventures pursuing simultaneous experimentation affect the overall performance of VC investment portfolios? VCs usually spread their risk by investing in focussed ventures with opposite business models. Whereas simultaneous experimentation spreads the risk within the venture, the fact that business models are

constantly evolving may make it difficult for investors to balance different investments. We hope this research contribution will inspire future efforts in this area.

REFERENCES

Abernathy, W.J. & Utterback, J.M. (1975). A dynamic model of product and process innovation, *Omega* 3 (6): 639-656.

Abernathy, W.J. (1978). *The productivity dilemma*. The Johns Hopkins University Press: Baltimore, MD.

Abbott, A. (1990). A Primer on Sequence Methods. *Organization Science* 1:373-392.

Aldrich, H.E. and Auster, E.R. (1986). Even dwarfs start small. In B.M. Staw and L.L. Cummings, (eds.), *Research in Organization Behavior* 8: 65-198. JAI Press: Greenwich, CT.

Alvarez, S.A. and Barney, J.B. (2007). Discovery and creation: alternative theories of entrepreneurial action. Strategic Entrepreneurship Journal 1 (1-2): 11-26.

Amit, R. and Zott, C. (2001). Value creation in e-business. *Strategic Management Journal* 22: 493-520.

Anderson, P. and Tushman, M. (1990). Technological discontinuities and dominant designs: a cyclical model of technological change. Administrative Science Quarterly 35(4): 604-633.

Andries, P. & Debackere K. (2007). Adaptation and performance in new businesses: Understanding the moderating effects of independence and industry. *Small Business Economics* 29: 81-99.

Arthur, W.B. (1989). Competing technologies, increasing returns, and lock-in by historical events. *Economic Journal* 99 (394): 116-131.

Autio, E. & Lumme, A. (1998). Does the innovator role affect the perceived potential for growth? Analysis of four types of new, technology-based firms. *Technology Analysis and Strategic Management* 10 (1): 41-54.

Barney, J.B., Wright, M., and Ketchen, D. (2001). The resource-based view of the firm: ten years after. *Journal of Management* 27 (6): 625-641.

Barney, J.B. (1999). How firm capabilities affect boundary decisions. *Sloan Management Review* 40 (1): 19-32.

Barney, J.B. (1991). Firm resources and sustained competitive advantage. *Journal of Management* 17 (1): 99-120.

Bhide, A. (1992). Bootstrap finance: the art of start-ups. *Harvard Business Review* 70 (6): 109-117.

Bhide, A. (1996). The questions every entrepreneur must answer. *Harvard Business Review,* 74 (6): 121-130.

Bhide, A. (2000). *The Origin and Evolution of New Businesses*. Oxford University Press: Oxford.

Brown, S.L. & Eisenhardt, K.M. (1998). *Competing on the edge: strategy as structured chaos*. Harvard Business School Press: Boston, MA.

Brown, S.L. & Eisenhardt, K.M. (1997). The art of continuous change: linking complexity theory and time-paced evolution in relentlessly shifting organizations. *Administrative Science Quarterly* 42: 1-34.

Buchanan J.M. & Vanberg V.J. (1991) The market as a creative process. *Economics and Philosophy* 7: 167-187.

Camerer, C. & Weber, M. 1992. Recent developments in modeling preferences: uncertainty and ambiguity. *Journal of Risk Uncertainty* 5: 325-370.

Chakravarthy, B.S. (1982). Adaptation: a promising metaphor for strategic management. *Academy of Management Review* 7 (1): 35-44.

Chandler, G.N. & Lyon, D.W. (2001). Issues of Research Design and Construct Measurement in Entrepreneurship Research: The Past Decade. *Entrepreneurship: Theory and Practice* 25 (4): 101-113.

Chesbrough, H. (2003). The governance and performance of Xerox's technology spin-off companies. *Research Policy* 32 (3): 403-421.

Chesbrough, H. & Rosenbloom, R.S. (2002). The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. *Industrial and Corporate Change* 11 (3): 529-555.

Choi, Y.R., Lévesque, M. and Shepherd, D.A. (2008). When should entrepreneurs expedite or delay opportunity exploitation? *Journal of Business Venturing* 23 (3): 333-355.

Cohen, B. & Winn, M.I. (2007). Market imperfections, opportunity and sustainable entrepreneurship. *Journal of Business Venturing,* 22 (1): 29-49.

Cook, T.D. and Campbell, D.T. (1979). Design and conduct of quasi-experiments and true experiments in field settings. In Dunette M.D. (Ed.), *Handbook of Industrial and Organizational Psychology*. Rand McNally, Chicago, IL, 223-326.

Corbett, A.C. (2007). Learning asymmetries and the discovery of entrepreneurial opportunities. *Journal of Business Venturing* 22 (1): 97-118.

De Carolis, D. M., & Deeds, D. L. (1999). The Impact of Stocks and Flows of Organizational Knowledge on Firm Performance: An Empirical Investigation of the Biotechnology Industry. *Strategic Management Journal* 20: 953-968.

De Carolis D.M., Yang, Y., Deeds D.L. & Nelling E. (2009) Weathering the storm: the benefits of resources to high-technology ventures navigatin adverse effects. *Strategic Entrepreneurship Journal* 2 (3): 147-160.

Delmar, F., & Shane, S. (2004). Legitimating First: Organizing Activities and the Survival of New Ventures. *Journal of Business Venturing* 19 (3): 385-410.

Delmar, F., & Shane, S. (2006). Does Experience Matter? The Effect of Founding Team Experience on the Survival and Sales of Newly Founded Ventures. *Strategic Organization* 4 (3): 215-246.

Dowell, G. & Swaminathan, A. (2006). Entry timing, exploration, and firm survival in the early U.S. bicycle industry. *Strategic Management Journal* 27: 1159-1182.

Druilhe, C. & Garnsey, E. (2004). Do academic spin-outs differ and does it matter? *Journal of Technology Transfer* 29: 269-285.

Dutta, D.K. and Crossan, M.M. (2005). The nature of entrepreneurial opportunities: understanding the process using the 4I organizational learning framework. *Entrepreneurship Theory and Practice* 29 (4): 425-449.

Dyer, J. and Singh, H. (1998). The relational view: cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review* 23 (4): 660-679.

Eckhardt, J.T. and Shane, S.A. (2003). Opportunities and entrepreneurship. *Journal of Management* 29 (3), 333-349

Eisenhardt, K.M. & Schoonhoven C. (1990). Organisational growth: linking founding team, strategy, environment, and growth among U.S. Semiconductor Ventures, 1987-1988. *Administrative Science Quarterly* 35 (3): 504-529.

Eisenhardt, K.M. (1989). Building theories from case study research. *Academy of Management Review* 14 (4): 532-550.

Fernhaber, S.A. and McDougall-Covin, P.P. (2009). Venture capitalists as catalysts to new venture internationalization: the impact of their knowledge and reputation resources. *Entrepreneurship: Theory & Practice* 33 (1): 277-295.

Fiegenbaum, A. and Karnani, A. (1991). Output flexibility – a competitive flexibility for small firms. *Strategic Management Journal* 12 (2): 101-114.

Fisher, G. (2008). Means versus goals: how uncertainty drives effectuation and causation in the new venture creation process: Working paper. University of Washington.

Galbraith, J. R. (1977). Organization design. Addison-Wesley: Reading, MA.

Garud, R. & Van de Ven, A.H. (1992). An empirical evaluation of the internal corporate venturing process. *Strategic Management Journal* 13: 93-109.

Gersick, C. J. G. (1991). Revolutionary change theories: A multilevel exploration of the punctuated equilibrium paradigm. *Academy of Management Review* 16 (1): 10-36.

Gibbert, M., Ruigrok, W. and Wicki, B. (2008). What passes as a rigorous case study? *Strategic Management Journal* 29 (13): 1465-1474.

Gruber, M., MacMillan, I.C. and Thompson, J.D. (2008). Look before you leap: market opportunity identification in emerging technology firms. *Management Science* 54 (9): 1652-1665.

Hamel, G. (2000). *Leading the revolution*. Harvard Business School Press: Boston, MA.

Hmieleski, K.M. and Corbett, A.C. (2008). The contrasting interaction effects of improvisational behavior with entrepreneurial self-efficacy on new venture performance and entrepreneur work satisfaction. *Journal of Business Venturing* 23 (4): 482-496.

Janesick, V.J. (1994). The dance of qualitative research design. In: N.K. Denzin & Y.S. Lincoln, eds., *Handbook of Qualitative Research*. Sage: Thousand Oaks, CA.

Jarillo, J.C. (1995). *Strategic networks*. Butterworth-Heinemann: Oxford.

Jääskelaïnen, M., Maula, M., and Seppä, T. (2006). Allocation of attention to portfolio companies and the performance of venture capital firms. *Entrepreneurship Theory and Practice* 30 (2), 185-206.

Karlsson, C. and Nyström, K. (2003). Exit and entry over the product life cycle: evidence from the Swedish manfucturing industry. *Small Business Economics* 21 (2): 135-144.

Kirzner, I. M. (1997). Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach. *Journal of Economic Literature* 35 (1): 60-85.

Klevorick, A. K., Levin, R. C., Nelson, R. R., and Winter, S. G. (1995). On the Sources and Significance of Interindustry Differences in Technological Opportunities. *Research Policy* 24: 185-205.

Klein, P.G. (2007) Opportunity Discovery, Entrepreneurial Action and Economic Organization. *Strategic Entrepreneurship Journal*, 2, 3, 175-191.

Knight, F. 1921. *Risk, uncertainty, and profit*. University of Chicago Press: Chicago.

Kohtamäki, M., Kekäle, T. and Viitala, R. (2004). Trust and innovation: from spin-off idea to stock exchange. Creativity and Innovation Management 13 (12): 75-88.

Kruskal, J. B., and Wish, M. (1978), Multidimensional Scaling, *Sage University Paper series on Quantitative Application in the Social Sciences*, 07-011. Sage Publications: Beverly Hills and London.

Lerner, J. (1994). The Importance of Patent Scope: An Empirical Analysis. *RAND Journal of Economics* 25 (2): 319-333.

Liao, J. and Gartner, W.B. (2006). The effects of pre-venture plan timing and perceived environmental uncertainty on the persistence of emerging firms. *Small Business Economics* 27 (1): 23-40.

Lichtenstein, B.B., Dooley, K.J. and Lumpkin, G.T. (2006). Measuring emergence in the dynamics of new venture creation. *Journal of Business Venturing* 21 (2): 153-175.

Loch, C.H., Solt, M.E., Bailey, E.M. 2008. Diagnosing unforeseeable uncertainty in a new venture. *Journal of Product Innovation Management* 25 (1): 28-46.

Magretta, J. (2002). Why business models matter. *Harvard Business Review,* May 2002: 86-92.

Marsili, O. (2002). Technological Regimes and Sources of Entrepreneurship. *Small Business Economics* 19 (3): 217-231.

Mauer, R. (2008). Learning from technology ventures: the impact of causal and effectual behaviour on uncertainty. Paper presented at the Academy of Management Conference 2008.

Miller, P. & Friesen, D. (1984). *Organisations: a quantum view*. Prentice-Hall.

Minniti, M. and Bygrave, W. (2001). A dynamic model of entrepreneurial learning. *Entrepreneurship Theory and Practice* 25 (3): 5-16.

Mintzberg, H., Ahlstrand, B., & Lampel, J. (1998). *Strategy safari. A guided tour through the wilds of strategic management*. The Free Press: New York.

Morris, M., Schindehutte, M. and Allen, J. (2005). The entrepreneur's business model: toward a unified perspective. *Journal of Business Research* 58: 726-735.

Nicholls-Nixon, C.L., Cooper, A.C., & Woo, C.Y. (2000). *Journal of Business Venturing* 14: 493-521.

Pentland B. (1999). Building process theory with narrative: from description to explanation. *Academy of Management Review* 24: 711-724.

Pettigrew, A. (1990). Longitudinal field research on change: theory and practice. *Organization Science* 1 (3): 267-291.

Pettigrew, A. (1987). Context and action in the transformation of the firm. *Journal of Management Studies* 24 (6): 649-670

Porter, M. (1985). Technology and competitive advantage. *Journal of Business Strategy* 5 (3): 60-78.

Raynor, M. (2007). *The Strategy Paradox*. Currency Doubleday: New York.

Read, S., Dew, N., Sarasvathy, S.D., Song, M., & Wiltbank, R. (2009). Marketing under uncertainty: the logic of an effectual approach. *Journal of Marketing* 73 (May 2009): 1–18

Saemundsson, R. & Lindholm Dahlstrand, A. (2005). How business opportunities constrain young technology-based firms from growing into medium-sized firms. *Small Business Economics* 24 (2): 113-129.

Sarasvathy, S.D. (2008). Effectuation: elements of entrepreneurial expertise. Cheltenham, UK: Edward Elgar.

Sarasvathy, S.D. (2001). Causation and Effectuation: Toward a Theoretical Shift From Economic Inevitability To Entrepreneurial Contingency. *Academy of Management Review* 26 (2): 243-263.

Schrader, S., Riggs W. M. & Smith R. P. (1993). Choice over uncertainty and ambiguity in technical problem solving. *Journal of Engineering and Technology Management* 10 (1-2): 73-99.

Schumpeter, J.A. (1942*). Capitalism, Socialism, and Democracy*. Harper: New York.

Shane, S. (2001). Technological Regimes and New Firm Formation. *Management Science* 47 (9): 1173-1190.

Shane, S. (2003). *A general theory of entrepreneurship. The individual-opportunity nexus.* Northampton, MA: Edward Elgar.

Shepherd, D.A., Douglas, E.J., and Shanley, M. (2000). New venture survival: ignorance, external shocks, and risk reduction strategies. *Journal of Business Venturing* 15 (5/6): 393-410.

Simon, M. and Houghton, S.M. (2002). The relationship among biases, misperceptions, and the introduction of pioneering products: examining differences in venture decision contexts. *Entrepreneurship Theory & Practice* 27 (2): 105-124.

Solow (1996). Learning by Doing: Lessons for Economic Growth, In: *The Kenneth J. Arrow Lectures*, Stanford University Press.

Steensma, H.K., Marino, L., Weaver, K.M. & Dickson, P.H. (2000). The influence of national culture on the formation of technology alliances by entrepreneurial firms. *Academy of Management Journal* 43 (5): 951-973.

Stinchcombe, A. (1965). Social structure and organizations. In J. March (Ed.), *Handbook of organizations.* Chicago, IL: Rand McNally.

Teubal, M., Yinnon, T. & Zuscovitch, E. (1991). Networks and market creation. *Research Policy* 20 (5): 381-392.

Van de Ven, A.H. & Poole, M.S. (1990). Methods for studying innovation developments in the Minnesota innovation research program. *Organization Science* 1 (3): 313-335.

Van de Ven, A. & Polley, D.E. (1992). Learning while innovating. *Organization Science* 3 (1): 92-116.

Weick, K.E. (1979). *The social psychology of organizing*. Addison-Wesley: Reading, MA.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal* 5 (2): 171-180.

Wiklund, J. and Shepherd, D.A. (2008). Portfolio entrepreneurship: habitual and novice founders, new entry, and mode of organizing*. Entrepreneurship Theory and Practice* 32 (4): 701-725.

Williamson, O.E. (1981). The economics of organization: the transaction cost approach. *American Journal of Sociology* 87 (4): 548-577.

Williamson, O. 1975. *Markets and hierarchies*. Free Press: New York.

Winborg, J. & Landström, H. (1997). Financial bootstrapping in small businesses – a resource-based view on small business finance. In W.D. Bygrave et al. (Eds.), *Frontiers of Entrepreneurship Research*, Babson College: Wellesley, MA, 471-485.

Winborg, J. & Landström, H. (2001). Financial bootstrapping in small businesses: examining small business managers' resource acquisition behaviours, *Journal of Business Venturing* 16: 235-254.

Yin, R.K. (1994). Case study research: design and methods. In: *Applied social research methods series 5*. Sage: Thousand Oaks, CA.

Young, F. W. (1987). *Multidimensional scaling: History, theory and applications*. Lawrence Erlbaum: Hillsdale, NJ.

Zahra, S.A. (2008). The virtuous cycle of discovery and creation of entrepreneurial opportunities. *Strategic Entrepreneurship Journal* 2 (3): 243-257.

TABLE 1: Case study overview

Company	Activity	Uncertainty at founding	Data sources	Time period
Music	E-commerce	awareness of critical issues such as impact of internet on individuals' buying behavior, musical genres, geographical scope however, rate of diffusion unknown	e-mail correspondence, meeting reports, financial reports, business plans, 11 interviews with investors, founders and employees	Jan 1999 – July 2001
OOPs	SW Products that enable E-commerce	implicit assumption that B-to-C will be considerable market unawareness of the discrepancy between standardized solution and real settings, of the distribution approach, of market interest in B-to-B	business plans, 6 interviews with one investor, one consultant, one employee and two founders (one was interviewed twice)	Jan 1998 – Feb 2003
Image	Machine Vision Systems	difficult to estimate size of market and sub-segments high number of applications in different industries possible but unclear which one is best	business plans, , website, 2 interviews with 2 former CEOs	Jan 1983 – Oct 1988
L-goritm	Reverse Engineering and Quality Control	unawareness of relevance of sales approach, position HW producers, geographical scope	business plans, , website, 3 interviews with founder/CEO, 1 interview with co-founder, 1 interview with finance manager	Dec 1995 – June 2001
SiS	Secure communication Services	high expectations but also high uncertainty regarding impact of internet on individuals' buying behavior high uncertainty regarding market potential lack of knowledge of international marketing and lack of knowledge of fierce competition on home market	business plans, website, 2 interviews with founder	May 2000 – May 2005
RegMed	Biomedical regenerative medicine	lack of market knowledge uncertain results of clinical studies	business plans, website, 2 interviews with founder/CEO	Jan 2000 – Jan 2005

TABLE 2: Summary of main findings

	Focused commitment	*Simultaneous experimentation*
Range of business models	▪ commit to one business model during the initial phase of the venture	▪ experiment with multiple business models in parallel during the initial phase of the venture
Rationale	▪ promise of achieving learning effects and first-mover advantages ▪ clarity of business model results in increased mobilizing power (towards investors and other stakeholders)	▪ seen as a way to learn about a broad range of business models and to spread risk ▪ learning about one option can also reduce uncertainty about other business models in the portfolio
Implications for flexibility	▪ implies the development of a specialized, dedicated organizational structure, resulting in considerable expenditures ▪ when assumptions do not become reality, change will be of a radical nature	▪ uncertainty reduction facilitates the gradual narrowing-down of the range of experiments until a viable business model is found ▪ implies the development of a project-based organization of flexible employees; which becomes more elaborate and structured as portfolio is gradually narrowed down
Implications for financing	▪ external investors are convinced by focused business model ▪ external investors are unwilling to finance radical change when business model turns out to be unviable	▪ implies the use of low-cost probing strategies, inclusion of business models with short-term cash-generating potential, and/or resource spill-overs between different business models ▪ external investors are convinced of the usefulness of planned, simultaneous experimentation. They monitor progress for each business model experiment.

FIGURE 1: Results of multi-dimensional scaling

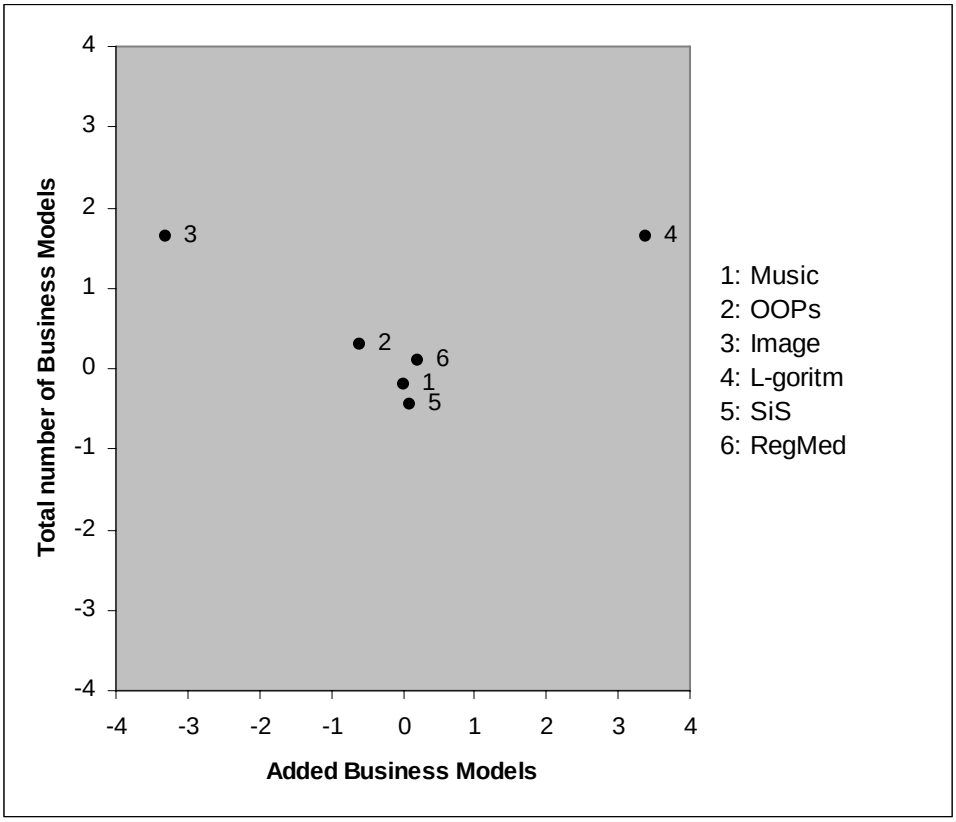


FIGURE 2: Event history of OOPs

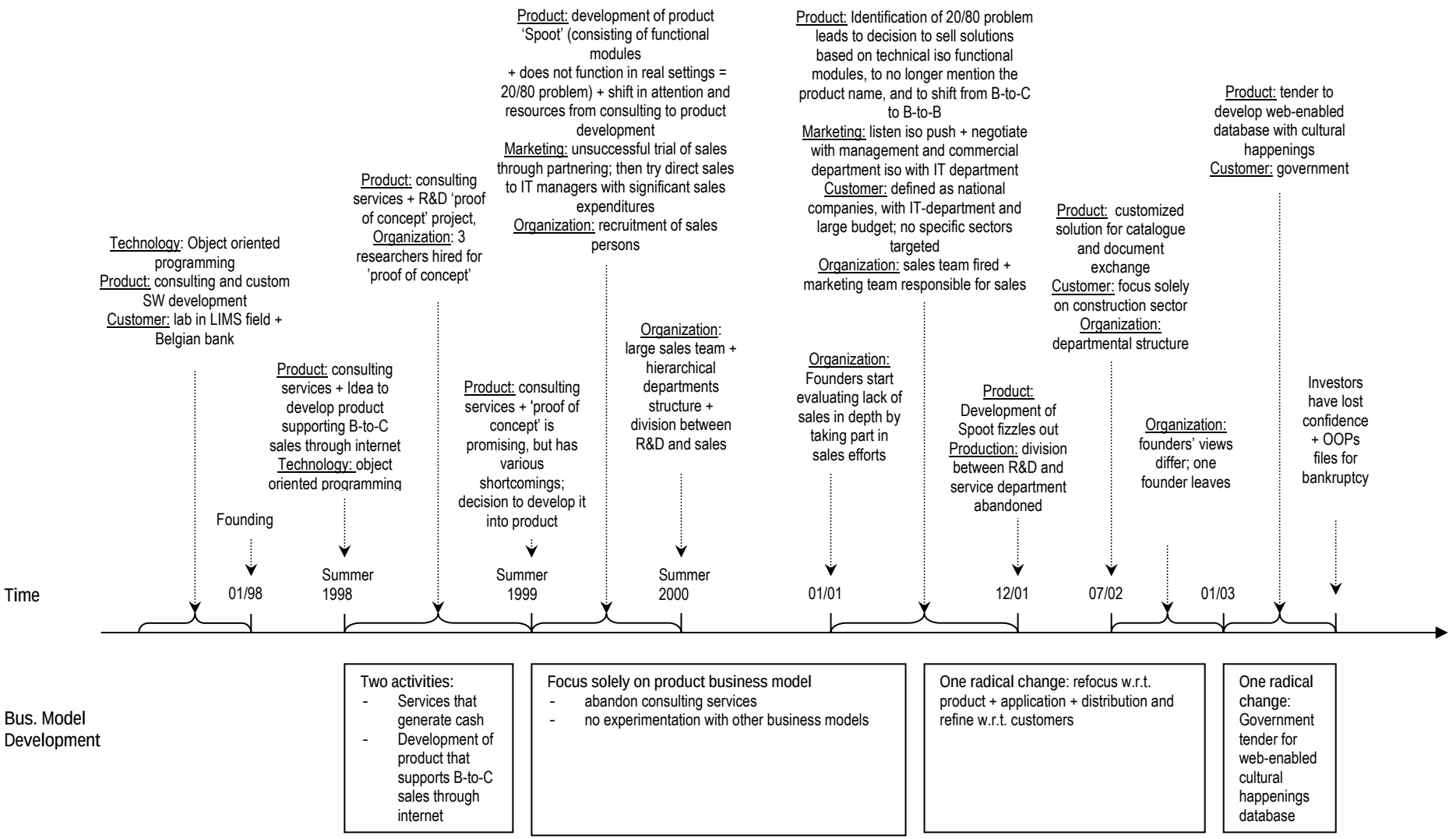
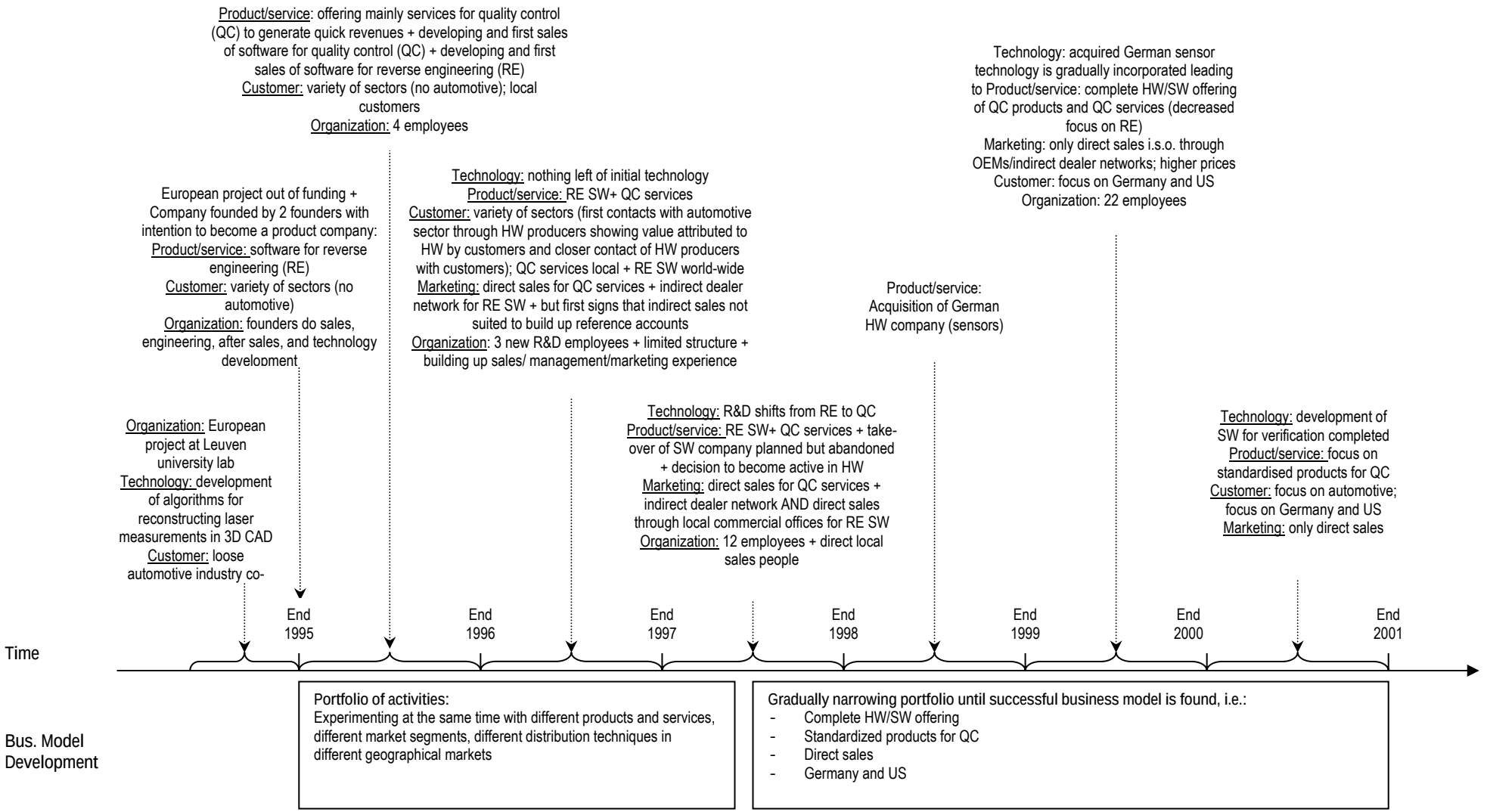


FIGURE 3: Event history of L-goritm



TEXT BOX 1: The story of OOPs

The story of OOPs

OOPs is established in January 1998 by two founders who have consulting experience in providing customized software services based on object-oriented programming. Initially, the venture continues these profitable consulting activities. However, soon after its founding, the idea emerges to develop – through object-oriented programming - a product that can support the development of applications for online B-to-C sales. Part of the necessary funding to develop a 'proof of concept' is obtained from a governmental organization. The company starts to make losses as a direct result of investment in this research. At the end of the research project, the concept proves promising, although the structure of the prototype and the different components show various shortcomings.

In mid-1999, the company decides nevertheless to develop the concept into a product and starts looking for investors. In total, €0.5 million of external capital is attracted from a financial institution and a private investor. With this capital injection, a product is developed that consists of different functional modules. A major problem soon arises during this period: the product offers an 80% solution for the customer's problem but adapting the product to solve the other 20% is more expensive than developing a customized product starting from scratch. This problem has not been recognized at the time, and will later be referred to as the 20/80 problem. At the same time, the capital injection is used to develop marketing and sales. Experienced sales people are hired, bringing the total number of personnel to about 15. Here also, an important problem arises. Test projects to sell the product remain unsuccessful. Despite these problems, investors support further commitment to the product activities. The profitable consulting activities are discontinued and efforts are redirected towards product development, in order to obtain learning effects and first-mover advantages in the internet market.

By mid-2000, the €0.5 million is spent, and an additional €0.1 million is invested by the financial institution and by a VC company. A new business plan is written, and external auditors value the company's product activities at €15 million. Technical improvements are made but the fundamental 20/80 problem remains unsolvable and unrecognized, and sales efforts still fail to reach targets. Investors believe that sales can be improved by hiring an experienced sales manager and a sales team of about 20 people. The company now has a clear structure, consisting of separate departments for sales, service, and R&D, with a clear division between R&D and services. Despite these structural changes and large expenditures, sales fail to improve.

At the beginning of 2001, the company founders start to evaluate sales results in depth. They conclude that the company's sales approach is wrong and recognize the 20/80 problem. It is decided that from now on negotiations will take place with the management and commercial department of potential clients instead of with their IT department, since the former are expected to be aware of the 'real' problems, whereas IT people are considered to be more concerned with technicalities. Although product development continues, the company no longer advertises products but 'solutions', consisting of technical modules based on existing capabilities and software. Because the interest in B-to-C solutions is smaller than expected, the company also decides to refocus on solutions for B-to-B commerce. Based on sales visits, the company founders define their target customers, namely national companies with an IT department and a minimum turnover of €25 million. The sales manager and his entire sales team are fired. The former marketing team assumes responsibility for sales. In December 2001, product development fizzles out. The distinction between 'R&D department' and 'service department' is abandoned, and all developers start working directly for the customer.

By July 2002, sales have grown somewhat (especially services and integration) but remain low. All efforts have shifted to the construction sector, where a consortium of players shows interest in catalogue and document exchange applications. However, due to decision-making problems within the consortium of potential customers, sales do not materialize. The founders now differ in their view on the right direction for the company and one founder leaves the company. This weakens the confidence of the investors, one of whom proposes that OOPs merges with another company in its investment portfolio. The remaining founder does not agree, however. At the start of 2003, he writes a proposal for a government tender to develop a web-enabled database of cultural events. The government is interested but asks the board of directors to confirm their support. The investors have however lost confidence and do not want to make this kind of official statement. The founder realizes that the company is not viable without the other investors' confidence. He resigns and OOPs files for bankruptcy.

TEXT BOX 2: The story of L-goritm

The story of L-goritm

Originating from a European research project at the University of Leuven, L-goritm is founded at the end of 1995 by two researchers as a university spin-off. The initial intention of the company is to be a product company, delivering software for reverse engineering to a variety of sectors. However, during the period 1995-97, its main activities are offering services for quality control, since this generates quick cash. Some reverse engineering services are offered. These services are offered to local customers – often reached through university contacts – in a variety of sectors (hospitals, providers of engineering services, producers of furniture, shoes, molds, candy, consumer electronics, etc.). Although L-goritm is working on the development of software for reverse engineering and realises its first sales in this area, the software for quality control is completed first as support for L-goritm's service activities.

At the end of 1997, an indirect dealer network is set up for the distribution of quality control software as well as some reversed engineering software. A partnership is forged with dealers who distribute the L-goritm software all over the world (incl. Taiwan, Korea, Singapore) to a variety of sectors. This partnership allows L-goritm to learn about and to copy parts of their management, marketing know-how and strategy. Revenues increase. In the meantime, L-goritm is still selling services for quality control (and some reverse engineering services) in Belgium. Through hardware producers (especially producers of scanning material), L-goritm comes into contact for the first time with foreign automotive constructors. In 1998, the business model is extended to direct sales by setting up local commercial offices because the indirect approach has proven to be less suitable to build up reference accounts. In addition, R&D efforts are directed to point-cloud-based verification for quality control instead of reverse engineering. However, there is still considerable service activity. These additional activities lead to very good financial results in 1998.

A take-over of a software company is planned but is abandoned later on. From contacts with hardware producers and from its service activities, L-goritm has found, firstly, that customers attribute considerable value to the hardware, even though software is in reality the most important for total performance and, secondly, that hardware producers are in closer contact with the customer. Therefore, L-goritm decides to become active in hardware activities as well, since this will allow them to be in close contact with the customer, to offer a total solution, and therefore to reach the total available customer budget without having to negotiate with hardware producers on division of the profit. In 1999, L-goritm acquires a German company specialised in the development of optical measuring equipment. This makes a complete product offering of SW and HW possible, in addition to SW sales and HW sales. In 2000, the management obtains a government loan to buy out shareholders who had swapped shares in the German acquisition. The acquired technology is gradually integrated, leading to a complete offering of software and sensors. The company is EBITDA break-even for the first time. During the period 1999-2000, after the German acquisition, it is decided to sell directly instead of through OEMs, to sell at higher prices, and to sell mainly to the US and Germany, thereby reducing geographical diversification. By mid-2001, the development of standardised software products for quality control is completed, and the automotive sector is chosen as the main target segment. No more R&D or sales efforts are carried out in the area of reverse engineering, which constitutes a negligible part of total turnover (about 5%).The first two quarters of 2001 show a 70% growth in revenue compared to the same quarters in 2000, and a positive net profit. The total headcount is 30.